Mutual-Care:
Users will love their imperfect social assistive robots

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Abstract. Would a user develop more affection towards her robot when it behaves rather like a clumsy dog or a perfect butler servant? In our quest for more acceptance of social assistive robots we define a new idea called Mutual-Care that looks into social and psychological explanations of user behaviour and defines new roles for the robot as well as the user. We present the conceptual derivation and work in process to implement this paradigm in order to study the new roles for user and robot.

Keywords: long-term acceptance, social robots, mutual-care

1 Introduction

From past experiences we know that acceptance, usability, and affordability are the main factors that render service robots successful. It is important to study these factors, so that future social robots can be designed to the wishes and demands of the user, which is important for the future diffusion and adoption of robotic technology.

If we take a closer look on robotic technology, we see that on one side, robots are utilitarian and productivity-oriented systems. On the other side, social robots try to engage users following human social rules. Fong et al. [1] conclude: “If technology adheres to human social expectations, people will find the interaction enjoyable, feeling empowered and competent.” Therefore, service robots are both, technological helpers for household tasks and social interaction partners for their owners.

Present solutions for interaction possibilities are not yet able to build and sustain long-term relationships, for example friendships, with their users [2]. Relationships usually involve some level of interdependence and mutuality. People in a relationship tend to influence each other, share their thoughts and feelings, and engage in activities together. Therefore most things that change or impact one member of the relationship will have some level of impact on the other member [3].

In this paper, we will shortly discuss the social and psychological influences on human behaviour especially towards social assistive robots and introduce a new, more user-friendly idea called *Mutual-Care*. We will present our hypothesis to propose this new paradigm, discuss theory and implications, outline work to study the new defined roles for user and robot, and summarise with the description of future work.

2 Theory

From a social point of view, the Helper Theory [4] states that members of a group, who help each other mutually, have a more positive affiliation to their group than members who only receive help. According to this theory, through the process of helping others, the helper gains an increased sense of self-efficacy [5], i.e., the helper improves her own abilities by using them to help others. Members of groups who benefit from mutually helping relationships have a greater sense of well-being and a more positive opinion about their group than members of groups where the roles of helper and help receiver are clearly separated [6].

Applied to human-robot interaction research, this means that the design focus shifts from the cognitive and emotional effects elicited by the robot to the different roles which can be taken by humans and robots. A user not only in the role of the help receiver but also in the role of the helper benefits more from the relationship with the robot and develops a greater sense of well-being, an increased sense of self-efficacy and a more favourable opinion of the relationship as described in Figure 1.

Based on this theory we hypothesise that given the possibility to "take care" of the robot like a family member, the user may develop affection toward it and this may have a positive effect on the long-term bonding. As robot and human take care of each other mutually, we will call this paradigm *"Mutual-Care"*.

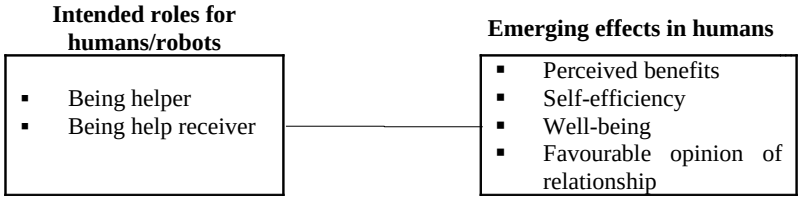

Fig. 1. Being helper and help receiver within a human-robot relationship increases cognitive and emotional benefits as well as the group feeling.

A social robot that is designed following the *Mutual-Care* paradigm, should encourage the user to help and care for the robot. By providing the user with this opportunity, we put the user in the role of the helper. It might be easier to expect and accept assistance from a robot if the user can also assist the machine in certain situations.

From a psychological point of view, Malle [7] describes the "folk theory of mind" as „a sophisticated conceptual framework that relates different mental states to each other and connects them to behaviour". Furthermore he states that „having an appreciation for the workings of the mind is considered a prerequisite for natural language acquisition, strategic social interaction, reflexive thought, and moral development and that perceivers expect mental states of other agents to be roughly of the same nature as their own mental states and therefore use their own minds to simulate others' mental states".

People not only form mental models of humans, they form anthropomorphic mental models of animals, deities, nature, animated objects or machines. Kiesler and Goetz [8] argue that as these models seem to be universal and intuitive, they may help understand users' responses to autonomous robotic assistants.

Unstructured interviews with people of different ages and demography show that many assign a mental model of a primitive human adult to the social assistive robot, and, when the robot does not confirm their expectations – which naturally happens very often – they change their mental model drastically to that of a "stupid machine". This negative shift in expectations causes mistrust and non-acceptance.

By assigning the mental model of a pet, a child, or a combination of both (e.g. puppy) to a social robot, people soften their expectations. Errors or misbehaviour are more easily tolerated and even corrected when the possibility is given. When the robot acts in unexpected ways, the user will not only tolerate these actions but be willing to keep the interaction with the robot out of interest or entertainment as long as the robot stays in the limits of the mental model of the user.

Applied to the *Mutual-Care* paradigm, the robot either can take the role of the little helpless puppy that needs to be educated, or be the loyal animal friend that helps the user in certain situations. So the social assistive robot adapts to the user's personality and needs. In this context Dautenhahn [9] also suggests that „individualization and personalization are necessary due to human nature: people have individual needs, likes and dislikes, preferences and personalities that a companion would have to adapt to."

3 Implementation

In a first approach, we propose a functionality called "Ask&Learn". This function implements the ability of both, the user and the robot to inquire about important personnel facts – a mutual learning of the other's needs. A social assistive robot learns favourite objects of the user by asking about them, so that later on it can find them for the user. A first implementation of learning an object has been presented in [10], where we follow the object motion to learn more views when the user turns the object. In future work we plan to ask the user to rotate the object to obtain views from all sides. Vice versa, the robot also has objects that are important, for example the docking station for its survival, and therefore needs to show its discomfort in a "social manner" when the user blocks the access to it by himself or with an object.

In many situations, the robot has to remind or advise the user. But in other situations, the robot tries to improve its performance by asking the user questions, and in this way, seeks the advice (confirmation or rejection) of the user. With the ability to ask for help in case of uncertainty or a possible blackout the robot may even become sympathetic. A social assistive robot guides (and supports) a person walking from one place to another. Vice versa, the robot follows the user when appropriate. Thus, in some situations, the robot is the guide; in other situations, the roles change and the user is the guide for the robot.

4 Outlook

To confirm our hypothesis, our first study will engage an autonomous robot with test users in a laboratory setting. The robot will assume different roles – for example, a butler, a dog puppy or a trained dog – and act in different scenarios that oblige the test subjects to assume different roles – for example master, parent or pet owner. The robot will be able to ask questions and learn basic navigation and object recognition goals given by the user.

The factors from the Helper Theory – perceived benefit, self-efficiency, well-being and favourable opinion of relationship – and other complementing factors like level of contentment, "team" feeling, self-assurance and self-competence will be measured.

Furthermore there will be questions investigating the mental models formed by the test subjects during interaction. Especially the levels of sympathy to non-acceptance in relation to the expected and actual imperfection or "helplessness" of the robot will be measured.

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References

1. Fong,T., Nourbakhsh, I. and Dautenhahn, I.: "A survey of socially interactive robots", Robotics and Autonomous Systems, pp. 143-166 (2003)
2. Klamer, T., and Ben Allouch, S.: "Acceptance and use of a social robot by elderly users in a domestic environment". Proceedings of Pervasive Health 2010, Munich, Germany 22-25 (2010)
3. Berscheid, E. and Peplau, L. A.: "The emerging science of relationships". In H. H. Kelley, et al. (Eds.), *Close relationships*. (pp. 1–19). New York: W. H. Freeman and Company (1983)
4. Riessman, F.: "The 'helper' therapy principle". Social Work 10 (2): 27–32 (1965)
5. Roberts, L., Salem, D., Rappaport J., Toro, P.A., Luke, D.A. and Seidman, E.: "Giving and receiving help: Interpersonal transactions in mutual-help meetings and psychosocial adjustment of members". American Journal of Community Psychology 27 (6): 841–868 (1999)
6. Maton, K.: "Social support, organization characteristics, psychological well-being and group appraisal in three self-help populations". American Journal of Community Psychology 16 (1): 53–77 (1988)
7. Malle, B.: "Folk Theory of Mind: Conceptual Foundations of Social Cognition" In Ran R. Hassin, James S. Uleman & John A. Bargh (eds.), *The New Unconscious. Oxford Series in Social Cognition and Social Neuroscience*. Oxford University Press (2005)
8. Kiesler, S. and Goetz, J:. "Mental Models and Cooperation with Robotic Assistants". In Proceedings of Conference on Human Factors in Computing Systems (2002)
9. Dautenhahn, K.: "Robots we like to live with?! A developmental perspective on a personalized, life-long robot companion. Plenary session presented at *13th International Workshop on Robot and Human Interactive Communication*. IEEE (2004)
10. Zillich, M., Prankl, J., Mörwald, Th. and Vincze, M.: Knowing Your Limits - Self-Evaluation and Prediction in Object Recognition, IEEE/RSJ International Conference on Intelligent Robots and Systems IROS (2011)